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COMPUTER SYSTEM IN A VEHICLE

Background Information

The present invention relates to a computer system in a vehicle.

Systems currently used in vehicles, e.g. navigation systems or entertainment systems, are often independent of one another, or are dependent on one another in one way or another. For example, individual processors may be provided for navigation tasks, for representing the human-machine interface, for vehicle and climate control, etc. In partitioning a complex system among various processors having precisely circumscribed tasks, a very precise separation with a very precisely defined interface is necessary. This leads to a risk of failure or problems when there are conflicting instructions in the various system areas. If, on the other hand, one processor takes over a plurality of tasks, this processor must either be designed for the simultaneous execution of all the tasks, or declines in performance must be accepted when the processor is heavily loaded.

Advantages of the Invention

The partitioning of tasks and/or functions among at least two computers according to the characteristics of the task and/or function, one computer executing tasks and/or functions that are essentially vehicle-related (vehicle system or driver information system) while the other executes tasks / functions that are essentially not related to driving or to the vehicle (entertainment systems), has the advantage of permitting vehicle / driver information systems and entertainment systems to be considered separately. Above all, this makes it possible to design the entertainment system as an open system and the vehicle system as a closed system. In this way, the safety of the vehicle system is ensured despite the open architecture of the entertainment system (e.g., Internet connection, software downloading). Here, an open system is understood as one that is set up for communication with the external world, and which for example also permits the user to make changes to its software or its configuration, whereas a closed system does not offer these possibilities.

A particular advantage of such a partitioning is the scalability of the system with respect to different levels of equipment of the overall computer system and of the subsystems. Different levels of equipment of the system are enabled without requiring extensive modifications of the system. In this way, a vehicle controlling alone (climate control and driver warning systems), an expanded vehicle controlling (additionally including navigation, radio, etc.), and a high-end equipping (additionally including entertainment, information, etc.) can be achieved by expanding the computer system with additional hardware components (plus the required software).

In addition, an independence of cycles of innovation is advantageously achieved, because the non-driving-related system is designed as an open system and can thus rapidly follow cycles of innovation, while the driving-related system, which is subject to fewer cycles of innovation, does not take part in these modifications. This holds not only for the software, but also for the components of the consumer electronics, which are constantly becoming more powerful, and which can be exchanged due to the fact that the entertainment part of the system is an open system.

In addition, the subsystems in the vehicle are independent from one another with respect to their availability, so that for vehicle-relevant information, which must always be precisely available (e.g., navigational indications, driver warnings, etc.), availability is ensured, because information relating to entertainment (e.g., video display), does not load the driving-related part.

In addition, it is particularly advantageous that the bus or bus systems in the vehicle are always connected to the same subsystem, independent of any additional equipment, in particular entertainment equipment, that may be provided.

In addition, the present solution by partitioning contributes to a minimization of risk because the driving-related systems are separated from the entertainment systems, which can be liable to error, e.g. caused by the downloading of new functions. Likewise, in this way the predictability of the behavior of the driving-related part of the system is ensured.

Additional advantages result from the following description of exemplary embodiments, and/or from the dependent patent claims.

Drawing

In the following, the present invention is illustrated on the basis of the specific embodiments shown in the drawing. The single Figure shows an example of a computer system in which driving-related tasks and non-driving-related tasks are separated.

Description of Exemplary Embodiments

The computer system shown in the Figure is made up essentially of two processors that divide task areas that are essentially demarcated from one another. Besides the demarcated tasks, individually selected tasks are present that can be flexibly exchanged, in particular tasks that require high computing power. The demarcation takes place according to the characteristics of the functions, a distinction being made between driving-related functions and non-driving-related (entertainment-related) functions.

A first processor 10 (possibly in combination with a graphics processor) takes over driving-related functions and/or tasks, such as for example connection to vehicle bus systems such as CAN, MOST, etc., climate control, navigation, driver warning systems, evaluation and representation of a two-dimensional map for navigation, speech output, human-machine interface, etc. In other words, this subsystem realizes a driver information system, including an operating interface for vehicle functions. On the other side there is a processor 12 (together with a graphics processor) that is powerful and is for example used in conventional personal computers, and that takes over tasks that are not driving-related, for example game applications, Internet connection, video applications, entertainment systems in general (in particular for passengers), and that is set up for the downloading of new applications related to these functions, and that realizes the bus connection to entertainment electronics, such as for example PDAs, laptops, etc. Thus, in this way an entertainment and information system is realized.

The functions of this computer system are made up of functions from consumer electronics (especially entertainment functions) and driving-related electronics (especially driving functions and driver information functions) that are here respectively realized on separate

computers of the system. In an embodiment, there is an area of overlap between the entertainment and driving functions. For example, a three-dimensional graphic (e.g., a map for navigation as a driving-related function) can be used for entertainment and can be represented by the other (entertainment) processor. Another example is MP3 functionality, which, in connection with audio applications, actually belongs to the entertainment part. However, an MP3 decoding is also a standard function of the automobile radio (driving-related part), so that this decoding can be taken over in the entertainment processor or in the driving-related application. For example, MP3 decoding is important for speech output. For this reason, the two processors are connected to one another via at least one interface, so that the output data and/or the results of selected tasks, or brief, computing-intensive applications such as speech recognition or high-quality speech synthesis programs, can be sent in swapped fashion from the driving-related processor to the more powerful entertainment processor, or vice versa. The functionality required for this is then present in redundant fashion in both processors, so that if the entertainment system fails or is absent, the driving-related part can likewise realize the function.

In this context, the driving-related part of the computing system is always the master system, and the entertainment processor is the slave.

The Figure shows a preferred embodiment of the computer system. The depicted computer system 100 shows the driving-related part 100a, as well as a non-driving-related part 12. Driving-related part 100a is made up of a processor 10 and a graphics processor 11. Processor 10 comprises a CPU, various memories (Mem), and an interface for connecting to vehicle bus systems such as ATAPI, MOST, CAN, or to sensors or actuators of the vehicle system (e.g. GYRO). In addition, the processor has an interface, e.g. SPI, to graphics processor 11, and an additional interface to the non-driving-related part, e.g. a PCI interface. Graphics processor 11 is made up of a computing core with memory, and is on the one hand connected to processor 10 via an interface SPI, and is connected to display means for the driver via an additional interface, for example an RGB interface, and is connected via a third interface, for example an LVDS interface, with the graphics processor of non-driving-related part 12.

Non-driving-related part 12 has a multimedia processor 13 having high computing power, and also has a high-performance graphics processor 14 that can process high-resolution graphics,

including three-dimensional graphics. Processor 13 has a central unit (CPU) as well as various memories (Mem), and has a first interface to processor 10 of the driving-related part (PCI), a second interface (likewise PCI) to graphics processor 14, and an additional interface to bus interfaces, such as USB, IEEE, etc. Standard entertainment electronics or computers can be connected to these interfaces. Graphics processor 14, which is likewise provided with memory, has, besides the interface to processor 13, the above-mentioned interface LVDS to the graphics processor of the driving-related part of the computer system, as well as an additional interface for displaying graphics to the passengers of the vehicle. This interface is for example realized as an RGB interface.

The partitioning of the functions into driving-related and non-driving-related takes place according to their characteristics; the essentially driving-related functions, containing specific information connected with operating, navigating, and guiding the vehicle, or warning and orienting the driver, are realized in the driving-related part, while primarily non-driving-related functions, containing non-specific information for the guiding of the vehicle and for animation, entertainment, and information for the passengers, are realized in the entertainment part 12 of the computer system. For the driving-related functions, the focus is placed on maximum availability and reliability of the functionalities, because the functions are essential for driving the vehicle, as well as on internal linking with the vehicle buses. Such vehicle-specific functions include navigation systems, HMI logic systems or HMI managers that control or evaluate the displays and operation of the vehicle, speech recognition and/or speech synthesis software, programs for outputting driving instructions and/or driver warnings, and the representation of two-dimensional maps for orientation. Thus, in the broadest sense they concern driver-related HMI, or a driver information system. Non-driving-related functions include Internet browsers, download of services, representation of three-dimensional graphics, applications for passenger entertainment, games, video reproduction systems, digital video broadcast systems, mobile office functions, portable devices such as laptops, PDAs, etc., that can be connected to the entertainment part. In the entertainment part of the computer system, the focus is placed on the provision of maximum power for the functions and on the openness of the system (e.g. downloading software) as well as on external networking (for example with the Internet).

In a specific embodiment, the separation represented above has areas of overlap. For example, via the LVDS interface, graphics-intensive applications, e.g. three-dimensional representations such as a three-dimensional navigation map, or three-dimensional models for viewing vehicle settings, e.g. for climate or sound adjustments, animations (transition animations during mask changes, animated elements in masks, animated operating assistants, etc.), or background images having a high memory requirement that are associated with functions of the driving-related part, are calculated in the entertainment part, not in the driving-related part, due to the computing power required, and are exchanged via the LVDS interface. In addition, brief computing-intensive applications, e.g. speech recognition with natural voice activation and the expanded recognition possibilities associated therewith, as well as speech synthesis with improved output quality, are exchanged with the powerful processor 13 of the entertainment part, e.g. via the PCI interface, and are computed there. Here it is to be noted that the cited functions are present in redundant fashion, and can also be executed in the driving-related part in the case of failure or absence of the entertainment system. All other functions are present without redundancy.

Thus, it is essential that in a computer system the individual functions are partitioned according to their significance for driving the vehicle, so that driving-related functions, i.e., functions that are essential to the driver for driving the vehicle, are calculated in a driving-related processor, while non-driving-related systems, e.g., functions that are inessential for driving the vehicle and are used for entertainment, in particular of the passengers, are computed in a powerful multimedia computer, the two computers preferably being connected to one another via interfaces.